

# Search for the beta-decay of $^{54}\text{Mn}$

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The decay of  $^{54}\text{Mn}$  is well known to proceed by electron capture with a half-life of 312 days (Fig. 1). Although it is energetically possible for  $^{54}\text{Mn}$  to decay to the ground state of  $^{54}\text{Fe}$  by  $\beta^-$  decay or to the ground state of  $^{54}\text{Cr}$  by  $\beta^+$ , only upper limits have been set for these second forbidden decay modes.<sup>1</sup> The current limit on these branches is  $10^{-6}$  for the  $\beta^-$  decay and  $10^{-8}$  for the  $\beta^+$  decay. The difference in the branching fractions arises from the greater available phase space for the  $\beta^-$  decay. These hindered decay modes are the primary means by which a fully ionized  $^{54}\text{Mn}$  nucleus would decay. Such fully stripped ions are found in cosmic rays and abundances of  $^{54}\text{Mn}$  have been reported.<sup>2</sup> These relative abundances, combined with measured partial half-lives, provide a cosmic ray chronometer by which one can infer the cosmic-ray confinement time.

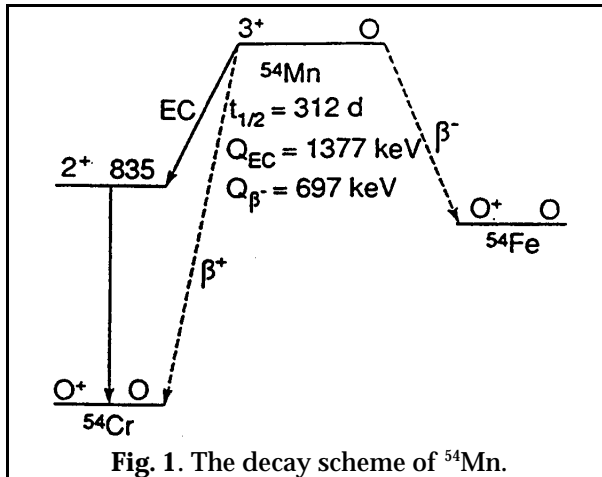


Fig. 1. The decay scheme of  $^{54}\text{Mn}$ .

Previous efforts<sup>1</sup> have used the characteristic annihilation radiation from positrons as a signature for the  $\beta^+$  decay. We intend to use annihilation radiation as a trigger with an apparatus designed specifically for such detection. The APEX spectrometer<sup>3</sup> was designed to detect the annihilation radiation of positrons created following heavy ion collisions. APEX is a 3 meter long solenoid which will be used to

transport positrons to a charge particle detector surrounded by a segmented annihilation radiation detector. The method has high efficiency and allows us to use an extremely intense radioactive source without suffer from the potentially large 835 keV gamma-ray background.

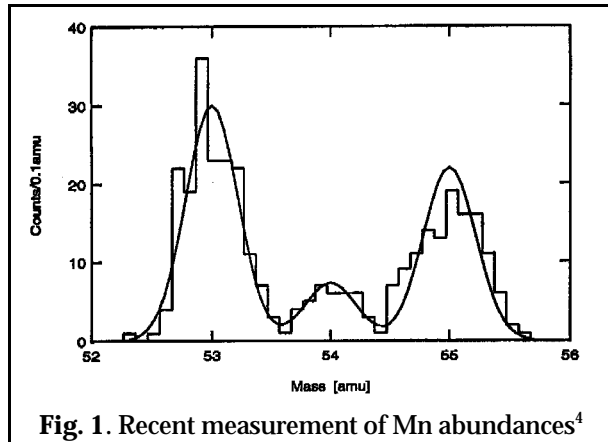


Fig. 1. Recent measurement of Mn abundances<sup>4</sup>

## Footnotes and References

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